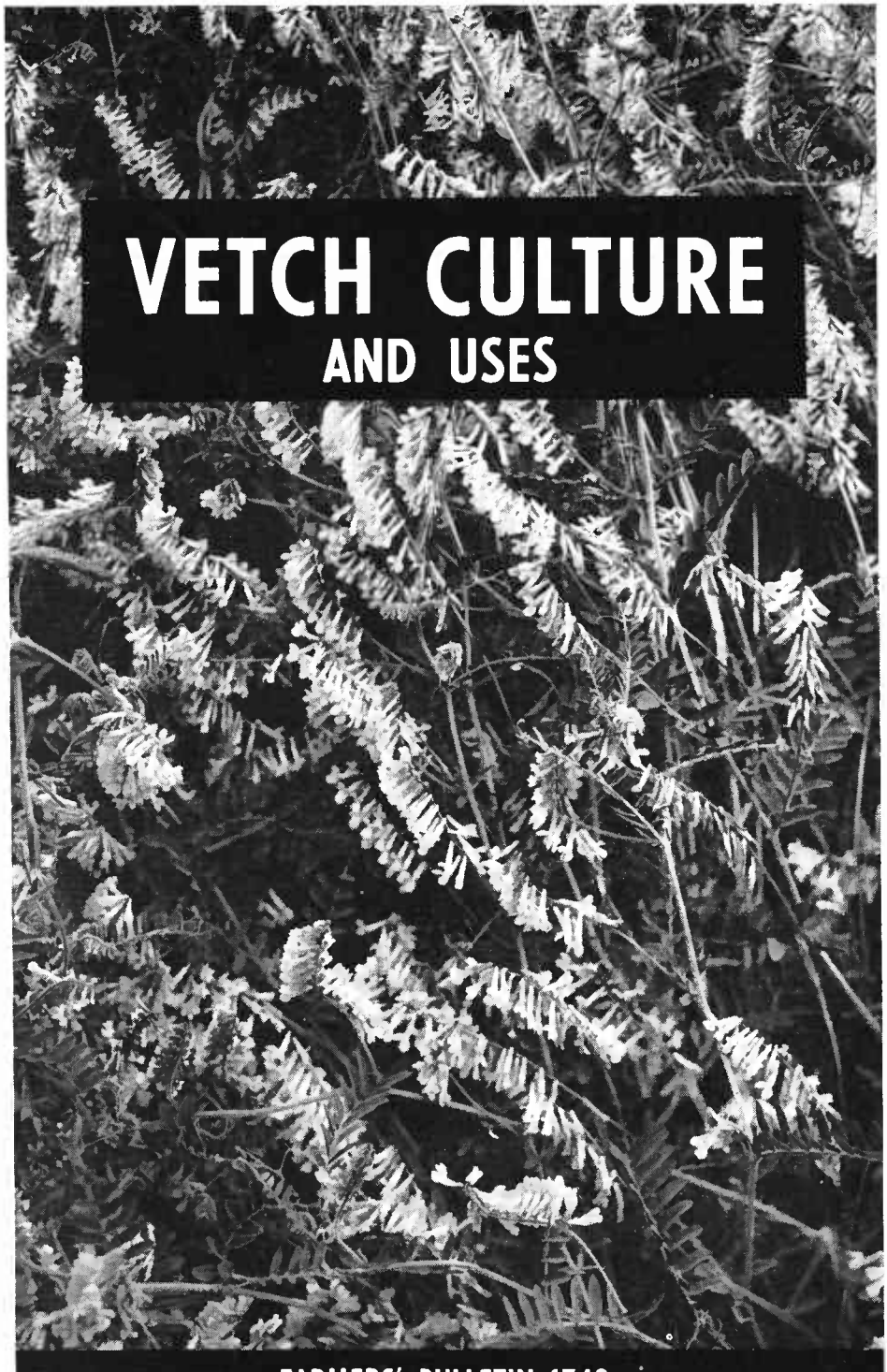

VETCH CULTURE AND USES

FARMERS' BULLETIN 1740
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VETCHES, either green or as hay, make excellent feed and are also used extensively as cover and green-manure crops.

They require cool temperatures for best development. Hairy vetch is the most winter-hardy of the commercial vetches and the only one recommended for fall planting in the North. Other varieties are fall-sown in the South and in the Pacific Coast States.

In most of the Cotton Belt, fertilizers and the use of inoculating cultures are essential to grow vetch; in the western part of the United States, inoculating and fertilizing are not so necessary. On lands that are low in fertility, however, both inoculation cultures and fertilizers can be used to advantage.

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VETCH CULTURE AND USES

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INTRODUCTION

PLANTS of the genus *Vicia* are commonly referred to as vetch. A large number of species are distributed throughout the Temperate Zones of both hemispheres, several of which have been recognized as of agricultural importance from very ancient times. Common vetch and hairy vetch have been used extensively in both the Old and New Worlds. One rather universally grown species of *Vicia*, *V. faba*, is seldom referred to as a vetch but is more commonly called horsebean, or broadbean. This species, grown mostly for its seed, which is used as a vegetable, is also used for green manure. Other species of *Vicia* are used largely for forage and green manure. The vetches of most importance are common, hairy, smooth, purple, narrowleaf, woollypod, bittervetch, monantha, Hungarian, and Bard. With the exception of bittervetch, which is grown in countries bordering the Mediterranean, these species are all used in the United States.

DESCRIPTION

The genus *Vicia* includes both annual and perennial plants. Most of the common vetches are annuals, however, and hairy vetch is either

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annual or biennial. With few exceptions vetches are more or less viny. The common agricultural species are all viny or weak-stemmed, with the exception of the horsebean, or broadbean, which is quite upright. The stems attain a length of from 2 to 5 or more feet, depending upon the species and conditions under which the plants are grown. In all cultivated species the leaves have many leaflets and are terminated with a tendril, excepting bittervetch and horsebean, which have little or no tendril. From few to many flowers are borne in a cluster or raceme. Seed and pod characteristics vary with species, but in general the seed is more or less round or oval and the pods elongated and compressed (figs. 1, 2, and 3). The common commercial vetches can be distinguished by the following simple key and short descriptions.

KEY TO COMMERCIAL VETCHES

Plants decidedly hairy.
- Flowers many in a cluster, stalked, purple.
  - Pods hairy, seed scar with white appendage ..... Purple vetch.
  - Pods smooth, seed round, seed scar smooth, without appendage ..... Hairy vetch.
- Flowers few (2 to 6) in a cluster, not stalked, nearly white ..... Hungarian vetch.

Plants smooth or nearly so.
- Flowers stalked.
  - Flowers many in a cluster, purple.
    - Pod smooth, seed round ..... Smooth vetch.
    - Pod finely hairy, seed oval to nearly round ..... Woollypod vetch.
  - Flowers one or few in a cluster, light lavender or nearly white (except Bard vetch).
    - Leaves without tendrils ..... Bittervetch.
    - Leaves with tendrils.
      - Seed decidedly flattened, flowers one, light lavender ..... Monantha vetch.
      - Seed oval or round, flowers two, purple ..... Bard vetch.
- Flowers not stalked.
  - Plants upright, leaves large and very broad to nearly round; seed very large ..... Horsebean.
  - Plants viny, leaves narrow to oval and obovate, seed not large, flowers purple.
    - Pods turning black, leaflets always narrow ..... Narrowleaf vetch.
    - Pods not turning black, leaflets seldom narrow ..... Common vetch.

CLOSE RESEMBLANCE IN VETCHES

Although some of the vetches have very distinctive characteristics, others are very much alike and sometimes are almost indistinguishable. Vetches representing different species will seldom be confused. Woollypod vetch (fig. 4) and smooth vetch, however, are hard to distinguish except by the pod and seed characteristics, and purple vetch is difficult to tell from hairy vetch until the flowers and pods are developed. Narrowleaf vetch is similar to some narrowleaf forms of common vetch and can only be told by its black pods and slightly different seed characteristics. Hairy vetch is distinguished by the heavy pubescence, or hairiness, of the stems and leaves from the few hairs or lack of hairiness in smooth vetch. The seed of these two varieties is indistinguishable. Woollypod vetch has slightly smaller flowers than hairy or smooth vetch, but its leaves and stems are like smooth vetch. Its seed, however, can be distinguished from these two varieties, since it is somewhat oval and has a groove through the middle of

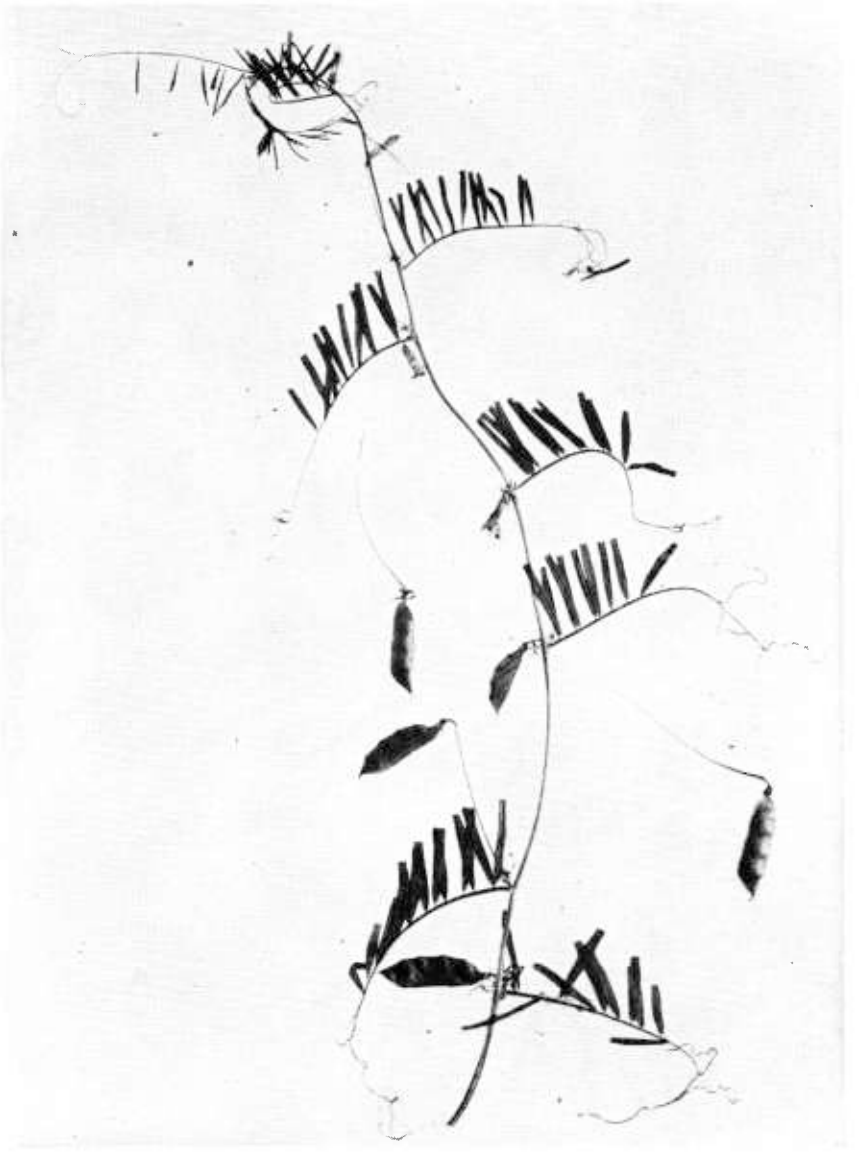

Figure 1.—Part of a stem of monantha vetch, showing leaves, flowers, and pods. (About one-half natural size.)

Figure 2.—Stem and seed pods of common vetch.

Figure 3.—Stem of purple vetch in flower.

the seed scar. Only a few varieties of common vetch are grown in the United States, and these are distinguishable only by the seed. Willamette vetch has mottled grayish-brown seed, and pearl vetch light-pink seed. The Willamette is the variety most extensively grown.

CLIMATIC REQUIREMENTS

The vetches require cool temperatures for their best development. In regions with mild winters, as in the Southern and Pacific States, they make their growth during the fall, winter, and early spring months, maturing in late spring and early summer. In the North,

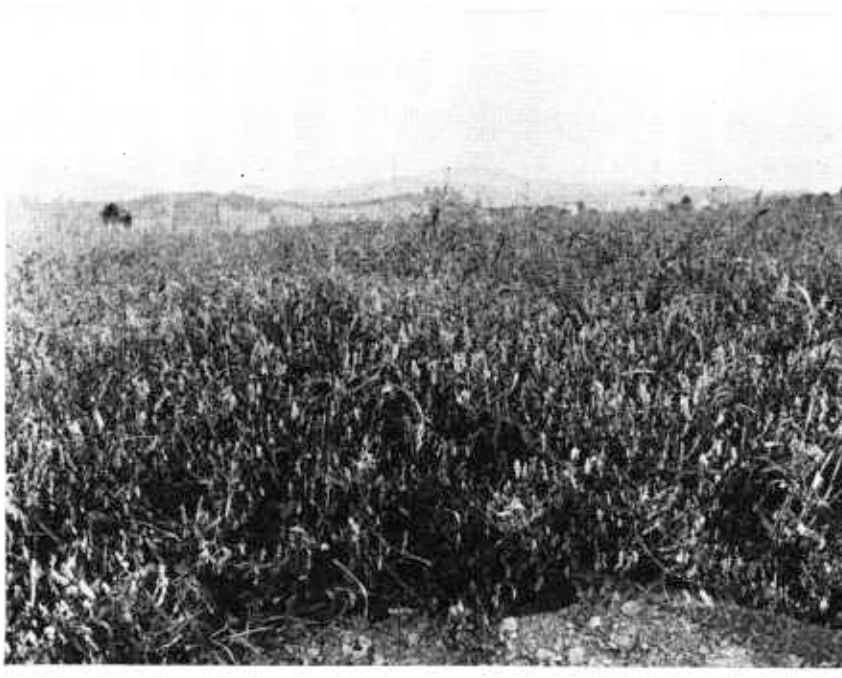

Figure 4.—Woollypod vetch in an experimental planting, showing general habit of growth.

where winters are severe and summers moderately cool, they start growth early in spring and mature late in summer or fall. Species vary with reference to winter hardiness and the minimum temperature at which they will make growth. Hairy vetch is the most winter-hardy of the commercial vetches and is the only one that is recommended for fall planting in the North.

In regions where temperatures do not fluctuate violently or where there is protection of snow, Hungarian, woollypod, and smooth vetches will stand a temperature of 0° F. or lower. Common vetch has a great many varieties, but without protection none will stand zero weather. The variety grown in the northwestern part of the United States under the name Willamette vetch is one of the most winter-hardy and in general can be said to stand 10° without injury under average conditions. Bittervetch, purple, monantha, and narrowleaf

vetches are all less hardy than Willamette vetch, and with fluctuating temperatures will suffer injury at 10° to 15°. In the Gulf Coast States, except in the extreme southern part, these vetches usually are injured by average winter temperatures. A few wild species of vetch are very winter-hardy. One of these, a native of the northern part of the United States, is known as bird vetch (*V. cracca*). This is a perennial and in some places occurs in considerable abundance.

USES OF VETCH

All of the commercial vetches make good hay, silage, pasture, and green manure, and can be used for cover crops and feeding green. The

Figure 5.—Oregon common vetch grown alone (left) and in combination with oats (right).

seed is used as one of the ingredients in ground poultry feed, which is frequently an outlet for surplus and waste.

The vetches make good hay either alone or in mixture with the small grains and are relished by all kinds of livestock. Common and Hungarian vetches are the species most generally used for this purpose, but hay from the others should be equally good. In river-bottom lands of the South where Johnson grass is established, narrowleaf vetch often occurs in abundance and makes up a good part of the hay from such areas.

Vetch planted with one of the small grains is often cut green and fed to cattle or other livestock. Common vetch is thus fed in western Oregon (fig. 5). Succulent late-winter and early-spring feed can be supplied in mild climates in this way with little expense.

For pasture the vetches alone or in mixture extend the grazing season by supplying late-fall and early-spring feed. They stand trampling and are well suited for pasture.

Probably the greatest use of vetch is for green manuring. In the past common and purple vetches have been used extensively for this purpose but are less used at present. Hairy vetch and smooth vetch are used for cover and green-manure crops in the Cotton Belt and make up about half of the green-manure and cover-crop acreage of that region. Monantha vetch is used for green manure and as a cover crop in the extreme South, and purple vetch is used for green manure in California. Hairy, smooth, common, Hungarian, monantha, and purple vetches are all grown for seed in limited areas of the United States.

CHEMICAL ANALYSES

The chemical analysis of any plant varies with its age; the protein content is high in young plants and the crude fiber low, while in old plants the protein is lower and the crude fiber higher. Plants with a high protein content are recognized as having high feeding value. The limited number of available chemical analyses of vetches indicate that the vetches are comparable in feeding value to clover, alfalfa, and other common legume crops. The protein content of hay usually ranges from 12 to 20 percent, depending upon the stage of development of the crop when cut.

SOIL AND MOISTURE REQUIREMENTS

In general vetches are not particular in regard to soil, although some do better on certain soils than others. All do well in rich loam. On poor sandy lands hairy, smooth, and monantha vetches do well, while Hungarian vetch succeeds on heavy wet soil where other kinds fail or make but little growth. A moderate moisture supply is necessary for vetches, and none are drought-resistant. Under dry-land tests hairy and purple vetches have stood up somewhat better than the others, but cannot be considered adapted to such conditions.

Vetches are more tolerant of acid soil conditions than most legume crops, and outside the lime-belt areas in the eastern part of the United States succeed without the addition of lime.

PREPARATION OF THE SEEDBED

In the South most of the vetch is seeded following cotton. Under such conditions little or no preparation of the soil is needed, as the cultivation of the cotton throughout the season makes a reasonably good seedbed. The same is true when the vetch is planted following soybeans, cowpeas, or Spanish peanuts, or any other cultivated crop. Under such conditions the seed is sown broadcast and disked in, provided the previous crop has been harvested sufficiently early.

On clay soils and where there is a heavy weed growth or the soil is firmly packed, plowing or heavy disking will be essential in order to give a good seedbed. For best results, it is desirable to have the soil reasonably well firmed, as this will insure better surface moisture conditions and consequently good seed germination.

In the Pacific Northwest disked seedbeds are used when vetch follows cultivated crops or spring-seeded small grains, while plowing and subsequent preparation is practiced on fall grain stubble or uncultivated

land. Usually no special soil preparation is practiced in orchards that have been clean-cultivated during the summer previous to seeding vetch for green-manure and cover-crop purposes.

TIME OF SEEDING

Latitude determines in a general way the time of seeding. In the extreme North or north of latitude 40°, from the Rocky Mountains to the Atlantic coast, all commercial vetches except hairy vetch should be sown early in spring. Hairy vetch in this region should be sown during August or early in September. On the Pacific coast west of the Sierra Nevada and Cascade mountains, with few exceptions vetches can be safely sown in the fall. In the colder parts purple vetch will occasionally winterkill, but in average winters it is hardy.

In western Oregon, western Washington, and northwestern California, vetch should be seeded as early as the seasonal rains will permit. Usually this will be in the latter part of September or early October. In other parts of California, where the climate is mild and where irrigation is practiced, seedings should be made from the middle of August to the first of October. In the mild parts of Arizona, seedings should be made about the same time as in California. For green-manure crops the planting date should be early, while for hay or pasture later seeding sometimes is equally satisfactory.

In the northern part of the Cotton Belt the best time for seeding vetch is the latter half of September and in the southern part early in October. Early seeding in the Cotton Belt is desirable, in order to get as much fall growth as possible, but where nematodes are numerous, early seedings may be seriously damaged. In general, seedings made about the first of October escape with but little nematode injury. Very late seedings, or seedings made as late as the first of December, will usually result in poor stands because of winterkilling, and little growth will be made by the time the crop should be turned under for corn or cotton.

RATE OF SEEDING

The rate of seeding to give good stands has been reasonably well determined by experimental work. Local variations in the soil, preparation of the seedbed, and winter temperature are factors that influence the rate of seeding. In general, the range of variation in the quantity needed is not great.

The quantity of seed per acre considered necessary for different vetches in various regions is given in table 1. When a seed drill is used, a smaller quantity is required than when the seed is broadcast, and thoroughly prepared land requires less seed than land that is rough and poorly prepared. Under favorable conditions the smallest quantity of seed indicated may be used, while under less favorable conditions the quantity should be increased.

In seeding in mixture with oats or other small grain for hay, the quantity of vetch seed should be reduced about one-fourth, while the grain should be reduced to about one-half the amount used in seeding it alone. When the hay is to be used for horses, the proportion of grain should be much higher than when the hay is intended for cattle or sheep.

TABLE 1.—*Quantity of vetch seed to use per acre when seeded alone*

Kind	Southern States	Northern and Western States	Kind	Southern States	Northern and Western States
	Pounds	*Pounds*		*Pounds*	*Pounds*
Hairy	20–30	30–40	Narrowleaf	20–30	----
Smooth	20–30	30–40	Purple	----	60–70
Common	40–50	60–80	Bard [1]	----	60–70
Hungarian	40–50	60–80	Woollypod	25–35	40–50
Monantha	30–40	60–70			

[1] Bard vetch is adapted only to the Southwest.

METHOD OF SEEDING

Vetches may be seeded either by broadcasting or by drilling. Broadcasting is the older method, but the use of the drill has greatly increased in recent years, especially in Oregon. Less seed is used by the drill method. Some growers have contended that there is less winterkilling when the seed is drilled. Experimental plantings, however, have not shown this difference.

The depth of planting varies with the type of soil. In loam soils good stands are obtained from plantings at a depth of 4 inches. Deeper planting will usually result in poorer stands, while shallower planting will give good stands when sufficient moisture is present. The surface-moisture condition should determine the depth of planting, which should not exceed 4 inches.

Vetch may be sown alone or with one of the small grains as a supporting crop (fig. 6). To sow with grain has been, and still is, the common practice where the crop is grown mainly for forage, as the grain furnishes a support for the weak stems of the vetch and to a considerable extent prevents lodging. Where oats succeed they are the favorite grain to use in combination with vetch, though wheat, rye, and barley may be used. Oats are especially useful when the crop is grown for seed, as the oat seed can be readily separated from the vetch seed, while there is greater difficulty with rye, wheat, or barley.

In Oregon, when grown as a seed crop, vetch sometimes is sown alone, but the price for threshing vetch alone in comparison with vetch with oats or other grain is the determining factor in this practice. In the sandy lands of Michigan, where the winters are severe, vetch is seeded in combination with rye. Where vetch is used mainly as a green-manure crop it is nearly always sown alone.

In the Cotton Belt, where vetch is used as a winter green-manure crop, seeding is done both by broadcasting and drilling. The green-manure crop follows cotton, and the seeding is made in the cotton middles. When the seed is broadcast it is covered with a 1- or 2-horse plow or cultivator equipped with disks or plows that cover the seed. If the seed is drilled, a 3-row 1-horse drill is often used. As the middle of the row is usually low and vetches will not grow well under such conditions, the middle hole should be closed when the

3-row drill is used. For hairy vetch and others with seed of similar size the sorghum plate should be used in the drill. Some farmers go twice to the row with a 1-row drill or with a fertilizer distributor that sows a mixture of seed, soil, and basic slag. Superphosphate is not mixed in this way because of danger of killing the inoculating organism. To avoid injury to the cotton, the drilling should be done immediately following a picking. In the lower part of the Cotton Belt the cotton is picked out before the vetch is planted. This will often permit the use of a large drill.

Furrows made by the small plows on the 1-horse drills should be filled by the use of a smoothing attachment, such as a scratcher,

Figure 6.—Hairy vetch in mixture with rye, showing the general habit of growth of the vetch.

chains, or a small chain harrow, to prevent the young vetch plants being covered with dirt and sand by the first heavy rains. This danger is greatest on sandy lands.

FERTILIZERS

In the Pacific Coast States fertilizers usually are not necessary for the successful growth of vetch. In western Oregon, however, gypsum, or land plaster, commonly applied at the rate of 75 to 150 pounds per acre, is often used with beneficial results. In the Southern States east of the Mississippi River it is almost universally necessary to use fertilizers. Superphosphate seems to be the one thing especially needed, but in planting vetch for the first time on land that has not grown legumes or received applications of nitrogen in commercial fertilizers, nitrogen in some available form should be included. For most parts

of the South, the use of from 300 to 400 pounds of 16-percent superphosphate per acre is recommended. This should be applied to the land preceding the planting of the vetch.

Nitrogenous fertilizers are seldom used, as inoculated vetch plants utilize the nitrogen of the air. By analysis vetch contains 2½ to 3½ percent of nitrogen, much of which is from the air; in other words, a ton of dry vetch contains about 60 pounds of nitrogen. A considerable proportion of this nitrogen is returned to the soil when the crop is harvested as hay and fed on the farm. If it is found necessary, however, to use nitrogen, nitrate of soda or sulfate of ammonia at the rate of 100 pounds per acre of the ordinary commercial form probably will be sufficient. Well-rotted barnyard manure at the rate of 15 to 20 tons per acre is one of the best fertilizers to insure a stand and good growth of vetch on land that has not grown this crop before, and much better inoculation has been obtained on land receiving a good application of barnyard manure. Little, if any, additional fertilizer is needed on lands regularly fertilized for a summer crop of cotton or corn.

INOCULATION

Inoculation is essential to the growth of all vetches, and the grower of vetch should make certain that the organism necessary to accomplish this is present in the soil in adequate numbers before omitting the use of artificial culture. In the Pacific Coast States vetch is nearly always naturally inoculated, the necessary bacteria apparently being present in the soil.

In the eastern part of the United States it is advisable to introduce the proper nodule organisms artificially unless it is known that they are already present. Many failures with vetch are directly attributable to the lack of inoculation. Inoculated plants are easily recognized by their greener color and more vigorous growth and by the nodules on their roots.

During the past two decades (1930–48) new facts have been learned about the root-nodule organisms commonly called legume bacteria. Formerly, when nodules were found on legume plant roots the crop was considered to be inoculated and the legume to be a soil builder, because the bacteria fixed air nitrogen in a form that the plants could use for their growth. Now it is known that there are strains of legume bacteria for a given legume that fix varying quantities of nitrogen—some are high nitrogen fixers, some good, some poor, and some form nodules but do not fix any nitrogen. Farmers have no quick way of telling whether the legume bacteria living over in the soil are the most effective type or whether they are ineffective.

Some farmers have had varying degrees of success in using soil for inoculating new seedings of legumes. This practice is not generally recommended because it is not known whether the soil contains the most effective legume bacteria in sufficient numbers to produce maximum benefits and because of the danger of spreading plant diseases and weed seeds from field to field.

One fundamental purpose of legume inoculation is to add a fresh culture of effective strains of legume bacteria to the seed, so that when the young plant begins to grow the bacteria will be right there to enter the tiny root hairs and begin fixing nitrogen in the early stages of the plant's growth. Farmers can now purchase legume inoculants

prepared with superior and selected strains of bacteria for different legumes, and, therefore, the simplest, easiest, and most economical way to insure successful growth is to inoculate legume seeds with these cultures before each planting. For additional scientific information on legume inoculation, see Farmers' Bulletin 2003, Legume Inoculation: What It Is, What It Does.

WINTERKILLING

The general winter hardiness of the various vetches and their regions of adaptation are discussed under the heading Climatic Requirements. It should be further noted that winterkilling in any variety of vetch cannot be connected with any definite temperature. The age, rate of growth, and vigor of the plant, the soil moisture, and winter protection are all factors directly involved in winterkilling.

Young plants from late seedings are often winterkilled when older plants of earlier seedings escape without injury. Plants growing rapidly because of high temperatures and ample moisture are injured more by freezing weather than plants that have been growing slowly and have had a gradual approach to a period of freezing.

The amount of moisture in the soil seems to have some relation to winterkilling. Seedings on wet lands will kill more easily than on well-drained land. This may be due in part to the effects of difference in soil-heaving, but most vetches do not thrive in soils that are wet during the winter months. Snow or any other loose covering lessens winterkilling. This is because a more uniform temperature is maintained about the plants and there is less soil-heaving.

HARVESTING FOR HAY

Vetch is ordinarily cut for hay when the first pods are well developed. When the crop is thin, cutting may be satisfactorily accomplished with an ordinary mower with a swather attachment (fig. 7).

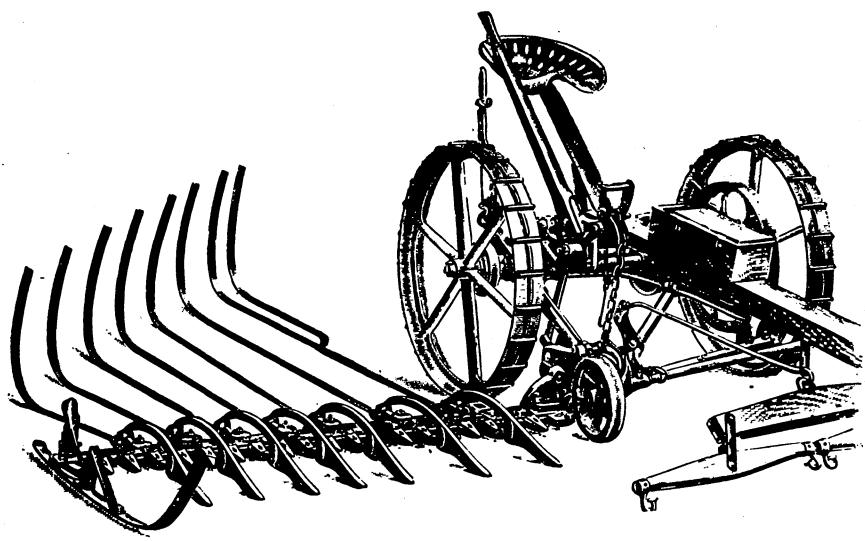

Figure 7.—A mowing machine equipped with lifter guards and a side-delivery bunching attachment for harvesting lodged vetch.

It is difficult, however, to cut heavy green vetch and use the swather. After being cut, the vetch should be windrowed with a side-delivery rake, if a swather is not used, or bunched with a horse rake and then shocked with pitchforks. This handling should always be done before the leaves are dry. Vetch should be allowed to cure in the shocks several days, and, if possible, hay caps should be used if rainy weather is feared. When a swather is not used, the harvesting is considerably more difficult. In either case it is the common practice to allow the vetch to lie a day before shocking. With most vetches it is difficult to obtain a bright-green-colored hay. Hungarian vetch is the best in this respect, and hay of this species handled properly can be cured so that the color is practically the same as when green.

When vetch is grown with a small-grain crop it should be cut for hay at the stage of its development just described. At that time the grain (if suitable varieties are used) will be in the milk or early soft-dough stage and will make good hay. Some growers make a difference in the time of cutting vetch, or vetch and grain hay, according to the class of livestock to be fed. For horses it is usually allowed to become more nearly mature than for either cattle or sheep.

It is sometimes desirable to pasture fall-sown vetch in the spring, in order to retard the haying season and also to prevent heavy lodging. This is often done in western Washington and western Oregon.

The yields of hay of the various commercial vetches are more or less comparable when they are grown under conditions to which they are entirely adapted. From 1½ to 3½ tons per acre is the usual range.

HARVESTING FOR SEED

The general practice is to cut common, hairy, smooth, woollypod, and other shattering vetches for seed as soon as the lower pods are fully ripe, at which time the upper pods will be fully formed and the plant will be carrying a maximum quantity of seed. Later cutting occasions more shattering of the seed, while earlier cutting results in a considerable percentage of immature seed. The practically non-shattering species, such as purple and Hungarian vetches, usually are allowed to ripen 75 to 90 percent of the pods before cutting. In places where very little seed is raised, the crop usually is cut with an ordinary mowing machine. Two men with pitchforks follow the mower and roll the vetch back from the uncut area, enabling the machine to get through when cutting the next swath. Sometimes the first-cut swath is rolled on the uncut vetch, and when the succeeding swath is cut the two are rolled back out of the way. This puts the vetch in larger swaths than the first-mentioned method and also may reduce the loss from shattering.

An ordinary grain binder is used by some growers, especially when the vetch is short and therefore quite erect or thin or when it is grown with a supporting crop, such as oats. When thus harvested the crop is put in shocks similar to grain shocks and allowed to dry thoroughly before being threshed. When the binder is used, however, the vetch should be cut a little greener than otherwise would be the case, as there will be some shattering of the pods caused by the canvases and packers. The bundles should be tied loosely so the material will dry rapidly and not mold.

The most common way of harvesting vetch at present in the Pacific Coast States is to use an ordinary mower with a swather attachment. The swather, which is attached to and behind the sickle bar, rolls the vetch in a swath to the outside and leaves the way clear to cut the next swath. The vetch is put at once into shocks and remains there until threshed, unless a combine with pick-up attachment is used, in which case the vetch is left in the windrow. Easily shattering kinds, as hairy vetch, should be shocked immediately after cutting.

The most important rule in the growing of vetch seed is to handle the crop as rapidly and as little as possible when cut.

In the southern part of the Cotton Belt, where vetch seed usually develops poorly, an occasional grower harvests hairy vetch seed. In this section the pods do not break open readily and the crop can be allowed to become dead ripe, allowing the vines with the pods to be raked from the field and threshed.

Vetches vary considerably in the yield of seed per acre. Common, Hungarian, monantha, and purple vetches in the Pacific Northwest probably average from 10 to 12 bushels of seed per acre, while 20- to 25-bushel yields are near the maximum. In that region hairy, smooth, and woollypod vetches yield about 6 to 7 bushels as an average and from 12 to 15 bushels as the usual maximum.

THRESHING

An ordinary grain thresher can be used for threshing all kinds of vetch, whether grown alone or in combination with a small grain. Vetches thresh somewhat slowly, and the cost per bushel is much greater than for either wheat or oats. The charge for threshing seed is usually by the hour. It is sometimes necessary, in order to prevent cracking of the seed, to remove a number of the concave and cylinder teeth of the thresher and to reduce the speed of the cylinder to 800 or less revolutions per minute. The adjustments that may be necessary seldom can be told beforehand and must be determined by the appearance of the threshed material as it comes from the machine. The screens that come with ordinary grain threshers can be used by properly adjusting them. The seed as it comes from the thresher, however, seldom will be sufficiently clean for marketing and will have to be run through special cleaners, in order to obtain a first-class product.

Combine harvesters are being used quite satisfactorily in the Pacific Northwest in harvesting the nonshattering or semishattering vetches. These machines are equipped with attachments that pick up the cut material from the windrow and pass it on to the separating machinery. Combining standing vetch is not considered satisfactory, because of heavy shattering loss.

CLEANING SEED

As it comes from the thresher vetch seed will contain more or less cracked seed, small straws, weed seeds and stems, chaff, and the small grain with which it may have been grown. Ordinary fanning mills and seed cleaners, usually available on farms or at warehouses, will separate readily most of the foreign matter and trash from vetch.

These machines will also separate quite readily the seeds of vetch and oats or barley, but wheat and rye seeds are not so readily separated from vetch seed. Separation of these, however, can be satisfactorily accomplished by the use of a gravity spiral seed separator (fig. 8), of the type recently introduced into general use in various regions growing vetch seed. Monantha vetch seed is more difficult to clean than that of most other vetches because of its flattened and somewhat oval shape and variations in size. When this seed is mixed with other kinds of vetch or with wheat it is often necessary to rely very largely on the spiral cleaner to separate them effectively.

Figure 8.—A spiral vetch separator, an efficient separator for removing rye or other small grain from vetch.

PASTURING

Common, hairy, and Hungarian vetches have been used for pasture. Common and Hungarian are utilized by Oregon and Washington dairymen for pasture during winter, spring, and early summer and are eaten eagerly by all farm livestock. As a general rule, vetch is pastured only when the ground is dry, to avoid packing the soil and to reduce the possibilities of bloat in cattle and sheep. Hairy vetch is seldom used for pasture in Washington and Oregon, the common and Hungarian being preferred, but in the eastern part of the United States, where hairy vetch is more commonly grown, it is pastured to some extent.

Even when vetch is grown primarily for hay or for seed, a limited degree of pasturing is often desirable, especially where the growth is likely to be unusually rank or where it is desirable to delay the harvest period. Hogs should not be used for this purpose, as they destroy many of the plants by biting them off below the crown. Sheep and calves do the least damage in pasturing vetch to be used primarily for hay or seed crop.

SOURCES OF SEED

Most of the seed of common, Hungarian, purple, and monantha vetches used in the United States is produced in this country. Although large quantities of seed of hairy and smooth vetches are produced in the United States, considerable seed is imported. The seeds of both kinds come in under the name hairy vetch, as they are indistinguishable.

Hairy vetch is produced in Europe in the countries bordering the Baltic Sea and south to Hungary; common vetch is produced in the more southern European countries and in the British Isles; bitter-vetch seed is produced in the Mediterranean region, especially in the eastern part, where it is used as stock feed. So far as known, Hungarian and monantha vetches are produced only in very limited quantities in southern Europe.

In the United States hairy vetch and smooth vetch seed is produced in Michigan, western Oregon, Texas, Arkansas, and western Washington; common and Hungarian in western Oregon and western Washington; monantha and purple in western Oregon, western Washington, and northwestern California; and woollypod vetch in western Oregon.

The production of vetch seed depends somewhat upon the commercial price, which in the past has been subject to decided fluctuations. Vetch reached a maximum price in 1919, when the grower received about 8 cents a pound for common and about 21 cents a pound for hairy. The minimum prices received by the grower have been about 1½ cents a pound for common and 5 cents a pound for hairy. Prices for Hungarian, monantha, and purple have ranged about the same as those for common vetch. Those for smooth and woollypod vetches have been about the same as those for hairy vetch.

LONGEVITY AND HARD SEED

Vetch seed with low moisture content retains its vitality under average conditions for a number of years. Germination tests made at Corvallis, Oreg., show that locally grown seed of the species tested retains its vitality with little or no decrease through a 5-year period and that seed much older often gives good germination. Seed with high moisture content, however, deteriorates rapidly. This is especially true when temperatures are high, as in summer or in warm climates. For this reason, all seed should be given a germination test before planting.

The species of vetch differ with respect to the proportion of hard seed they contain. Common, Hungarian, purple, and monantha vetches have little or no hard seed, while hairy, smooth, and woollypod vetches usually have from 5 to 25 percent.

VETCH IN ROTATIONS

In the Cotton Belt vetch serves well as a winter crop, to be followed by corn, cowpeas, soybeans, sorghums, millet, or any late-planted crop. When the summer crop can be planted very late, it is possible to utilize the vetch for winter and spring pasture or hay. If the sum-

mer crop must be planted early, the vetch should be used as winter pasture or green manure, or as a combination of the two.

In the Northern States it is sometimes possible to cut fall-sown hairy vetch early enough for hay, so that a late crop of millet can be grown. Other vetches in the North must be spring sown; they require the entire summer season for development.

Under irrigation in the Southwest, where the winters are mild, it is possible to grow vetch alone or in combination with a grain crop for hay or pasture during the winter and then grow a summer crop.

In the Northwest an entire season has to be given over to the vetch, but it is recognized as an excellent crop to use in rotation with the small grains and cultivated crops for the maintenance of soil fertility.

FUNGUS DISEASES

More than 20 fungus diseases have been reported that attack vetch species in the United States. The most common include the following: Downy mildew (caused by *Peronospora viciae*), anthracnose (caused by *Colletotrichum villosum*), false anthracnose (caused by *Kabatiella nigricans*), leaf and pod spot (caused by *Ascochyta pisi*), gray-mold leaf spot (caused by *Botrytis cinerea*), root and stem rot (caused by *Rhizoctonia solani*), and stem rot (caused by *Sclerotinia trifoliorum*). The diseases are generally confined to certain regions and environmental conditions; especially temperature and moisture limit their range and destructiveness. These conditions are responsible for anthracnose and gray-mold leaf spot in southern United States and for stem rot in the Pacific Northwest. Vetch species are known to vary in their reactions to respective diseases.

If vetches are grown only as a cover crop, it has been generally observed that diseases do not cause extensive damage. When grown as a seed crop, however, several of the diseases have been rather destructive.

INSECTS AND NEMATODES

Many insect pests of alfalfa, clover, and other forage legumes also attack vetch. Among the more important of these are aphids, the corn earworm, grasshoppers, cutworms, the fall armyworm, various weevils, and leafhoppers. The control of these pests on vetch is for the most part similar to the control of such insects on other forage legumes. Information is usually available on the biology and control of most of these insect pests, and although the damage caused by various species may look the same, the control measures are usually different. When injury is observed and information is desired, specimens of the insects causing the damage, together with a sample of the injured plant, should be sent to the State experiment station or to the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C.

The grower's attention should be called in particular to aphids, and he should be on the lookout for these little insects in the spring, as they multiply rapidly as the weather becomes warmer and may damage a crop seriously in a very short time. When it seems probable that aphids will destroy the vetch, it is advisable to cut the crop promptly, as a considerable tonnage of hay may thus be saved. In

the Cotton Belt serious damage may be done to a vetch green-manure crop if it is allowed to continue growth too late in the spring. The proper season, however, for turning under the green-manure crop for cotton or corn is sufficiently early to avoid serious damage. In the northern part of the Cotton Belt, aphid damage may be expected after April 15 and in the southern part after the last of March or early April. When aphids appear in abundance, the green-manure crop should be turned under or disked down at once. In the South, the corn earworm sometimes does serious damage to maturing or late-standing vetch.

All the commercial and other varieties of vetch as far as known are subject to attack by nematodes, and at times serious damage may result. Nematodes are most active in warm weather, and serious damage may be avoided by planting moderately late. In the Cotton Belt this means the last of September or early October, which will bring the growing season into the cooler part of the year.

COMMERCIAL VETCHES IN THE UNITED STATES

While hairy, common, and Hungarian vetches are the kinds most commonly used in the United States, others are used in limited areas and some of these offer possibilities of more extended use. To supplement the previous more general discussion, a short agronomic description of the different kinds of vetch is given.

HAIRY VETCH
(*Vicia villosa* Roth)

Hairy vetch, one of the oldest and most commonly used of the vetches, is grown in practically all the countries in the Temperate Zone and is extensively used in the United States. The stems are comparatively weak or viny, and the plants are conspicuously hairy throughout. This vetch is very winter-hardy and will stand the winter temperatures of the northern part of the United States except in areas where the ground is usually or often bare during the winter months and so affords little or no protection to the vetch plants. Hairy vetch is grown as a seed crop in parts of Michigan and in western Oregon. Seed also is grown in quantity in the European countries bordering on the Baltic Sea and in central Europe and is imported into the United States from that region.

SMOOTH VETCH
(*Vicia villosa glabrescens* Koch)

Smooth vetch is rather like hairy vetch in general, but differs in lacking the tufted growth at the ends of the stems and in having fewer hairs or less pubescence on stems and leaves. The seed is very much like that of hairy vetch and appears identical, and the two kinds are being sold under the name "hairy vetch," and often in mixture. Smooth vetch seems to be somewhat less winter-hardy than hairy vetch, although their exact relation in this respect has not been determined.

In the Southern States, smooth vetch has made somewhat more growth than hairy vetch during the winter months and is perfectly hardy throughout that region. It is well adapted to the Cotton Belt as a winter green-manure and forage plant. Seed is grown com-

mercially in North Carolina, Arkansas, northern Alabama, northern Georgia, and western Oregon, but is sold under the name of hairy vetch. Seed imported under the name "hairy vetch" is often this form.

WOOLLYPOD VETCH

(*Vicia dasycarpa* Ten.)

Woollypod vetch, which is similar to hairy and smooth vetches, is more nearly like smooth vetch and without the flowers and seed can hardly be distinguished from that variety. The flowers are a little smaller than either those of hairy vetch or smooth vetch, and the seed tends toward an oval shape instead of being nearly round, as in those varieties. The seed scar also has distinguishing marks that are apparent to the seed expert. The plant is comparatively smooth, or lacking pubescence. In winter hardiness, woollypod vetch is comparable with smooth vetch, although possibly a little less winter-hardy. It seems to be perfectly winter-hardy throughout the Cotton Belt and as far north as Washington, D. C.

Seed of woollypod vetch has been grown in western Oregon in very limited quantities and is not regularly available. This species makes a good winter growth in the South, and with cheap seed there is no reason why it should not be used for green manure and forage.

COMMON VETCH

(*Vicia sativa* L.)

Like hairy vetch, common vetch is of ancient origin. The plants are semiviny, having slightly larger leaves and stems than hairy vetch. Being less winter-hardy than hairy vetch, common vetch cannot be grown as a winter crop except in regions having a mild climate. In western Oregon and western Washington it is hardy in most winters, but it often winterkills in the northern part of the Cotton Belt. In the Pacific Coast States it is grown as a hay and seed crop, as well as for green manure, silage, and pasture. In the Southeastern States its use has been largely for green manure. There are a large number of varieties of common vetch, among which the one commonly grown for seed in western Oregon is one of the most winter-hardy. A strain recently introduced under the name Willamette vetch is quite vigorous growing and winter-hardy and seems well adapted to the more fertile soils of the Southeastern States. Pearl vetch is a variety of common vetch with light-pink seed, and is grown occasionally in western Oregon as a spring-sown crop.

HUNGARIAN VETCH

(*Vicia pannonica* Crantz)

Hungarian vetch is a native of central Europe, rather abundant in Hungary and adjoining territory. It has been introduced into cultivation in Europe but is less extensively grown than hairy or common vetch. This vetch is grown in western Oregon, where it has recently become of commercial importance. The plants are less viny than hairy vetch or common vetch and tend to be erect when the growth is short or when the plants have some support (fig. 9).

Both the stems and the leaves are covered with medium-long hairs, which give the plants a decidedly grayish color. A stem length of

from 3 to 4 feet is attained under favorable conditions, but under average conditions 2 to 2½ feet is more common. Hungarian vetch is rather winter-hardy and is comparable with smooth and woollypod vetches in this respect. Its exact limitations have not been determined, but it has survived winters as far north as Washington, D. C., without injury.

Hungarian vetch is especially well adapted to heavy clay soils and will do better in wet situations than other vetches. In the Southern States it has done poorly on sandy land. The seed habits of Hungarian vetch are good, and comparatively heavy yields of seed are obtained. Its commercial use is confined almost wholly to the Pacific

Figure 9.—**Hungarian vetch in full bloom, showing general habit of growth.**

Northwest, where it is grown as a hay, silage, green-manure, pasture, and seed crop. The seed is used to a limited extent in mixed ground feeds.

MONANTHA VETCH

(*Vicia articulata* Willd.)

Monantha vetch is a native of southern Europe, in which region it has been brought under cultivation, but as far as known it is used only in a very limited way. The plant is weak-stemmed and viny, and resembles hairy vetch in this respect. In comparison with other commercial vetches, it has very fine stems and leaflets and matures early.

Monantha vetch is not very winter-hardy, and for this reason it is adapted only to regions having mild winter climates. In the Cotton Belt, where winter temperatures are subject to great fluctuations, it has not been found regularly hardy except in the extreme southern part. In the Pacific Coast States it has survived the winters in the

milder parts of Washington, Oregon, and California. At the present time, monantha vetch is grown in a limited way for seed in northwestern California and in western Oregon. In orchards of Florida and southern Georgia, and to some extent in California, it is used for winter green manure. The seed habits of this vetch are good, and seed yields are comparatively heavy. Wherever it can be grown it will make a good green-manure and forage crop.

PURPLE VETCH

(*Vicia atropurpurea* Desf.)

Purple vetch is a native of southern Europe; from there it was introduced into the United States. It is a viny plant with much the habit of growth of hairy vetch but differs from that variety in pod and seed characters. Purple vetch is one of the least winter-hardy of the commercial vetches and for that reason is restricted in its range of usefulness. In the milder parts of California it is winter-hardy, but in western Oregon and Washington it occasionally winterkills. In the Cotton Belt, purple vetch has proved entirely unsuited, as it cannot stand the fluctuating winter temperatures. In this region it winterkills severely, except in the extreme southern part of Georgia and Alabama, and even there it occasionally will be severely injured.

Purple vetch has been grown as a seed crop in western Oregon, western Washington, and in northwestern California. In other parts of California it has been used as a green-manure crop and for hay. The seed habits are good, and seed yields comparatively heavy.

BITTERVETCH

(*Vicia ervilia* (L.) Willd.)

Bittervetch is not grown commercially in the United States, but is grown in parts of southern Europe and in Asiatic Turkey. The plants are more nearly upright in growth than most other vetches, although they lodge easily when making a rank growth. The seeds are conical or pyramidal in shape and smaller than those of Oregon common vetch. In the western part of the United States this vetch has made good growth and has produced good crops of seed, but it has never been considered superior to other vetches in common use. The seed is used for stock feed, especially for sheep. In the Cotton Belt it has made comparatively little growth and often has winterkilled, indicating that its use in that region will be limited. It makes very good growth in the Pacific Northwest and produces heavy seed crops.

NARROWLEAF VETCH

(*Vicia angustifolia* Grufberg)

Narrowleaf vetch, like the other commercial vetches, is of European origin, occurring in the United States mostly as a weed. Closely related to common vetch, it is very much like that species, but usually is distinguishable by its black pods, narrow leaflets, and smaller flowers. In the grainfields of the Spring Wheat Belt, it is found in abundance, and in the Cotton Belt it is everywhere along roadsides and in waste places wherever there is an accumulation of weed growth. Elsewhere in the United States it occurs in lesser abundance but usually persists by volunteering.

Seed of narrowleaf vetch is not regularly available in the seed trade. Occasionally it is harvested from volunteer stands in the South or saved from the screenings of the spring wheat crop in the Northwest.

A few orchardists of the South have found this a good crop for volunteering as a winter-cover and green-manure crop. The crop seems to succeed, however, only where there is good soil or where there is weed growth and an accumulation of organic matter. It volunteers in pasture lands and makes excellent pasture. Under cultivation, narrowleaf vetch has seldom succeeded.

BARD VETCH

(*Vicia monantha* Retz.)

The general habit of growth of Bard vetch is similar to that of hairy and common vetches. It has succeeded well in the irrigated areas of the Yuma and Imperial Valleys of the Southwest, where a very small acreage is grown. Farther north in the West, it cannot compete with the other vetches, and in the Cotton Belt east of the Mississippi River it has never succeeded.

HORSEBEAN

(*Vicia faba* L.)

Horsebeans, coarse, upright-growing plants having large, broad leaflets and large pods, differ decidedly in habit of growth from most of the vetches. There are many varieties of this species, most of which are grown for their seed. The small-seeded varieties are sometimes grown for green manure, but are more generally used as stock feed; the large-seeded varieties are used as a vegetable. Formerly a large acreage of horsebeans was grown in California, but at present the acreage is rather small; in other parts of the country horsebeans are occasionally grown as a home-garden vegetable.

The horsebean requires a cool season for its best development, and it is grown as a winter annual in the South wherever it will not winter-kill. In the North it is not winter-hardy, and even in the South it cannot be grown successfully where the temperature fluctuates rapidly.

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